This invention concerns a thrust nozzle for a gas turbine engine.

More specifically, the invention is concerned with a thrust nozzle, the outlet area of which can be varied, so as to cater for varying volumes of gas flow from a gas turbine engine which includes the nozzles.

The invention seeks to provide a variable area nozzle structure suitable for use as inter alia, a thrust vectoring nozzle i.e. one which is rotatable so as to emit propulsive gas flow in various directions.

According to the present invention, there is provided a variable area thrust nozzle comprising a tubular structure, curved in cross-section having an exhaust gas outlet, a flap mounted by one end, within the tubular structure about an axis which lies across said outlet, for pivoting movement about said axis between a position wherein said flap slopes towards a wall of said tubular structure and has its edges in sealing contact therewith and, a position wherein said flap lies parallel with said walls and moving means for achieving said movement.

The tubular structure may be circular in cross section.

Preferably the tubular structure comprises an elbow having that end remote from the exhaust gas outlet, adapted for connection to gas turbine engine structure for rotation relative thereto.

The invention will now be described, by way of example and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a gas turbine engine incorporating a pair of variable area thrust nozzles in accordance with an embodiment of the invention,

Figure 2 is an enlarged, cross-sectional part view of Figure 1.

In Figure 1 an aircraft power plant 10 comprises a core gas generator 12 driving a front fan 14. The fan duct 16 of front fan 14 terminates in a plenum chamber 18. The plenum chamber is divided into two portions 20, 22 each of which terminates in a respective propulsion nozzle 24, 26.

Propulsion nozzles 24, 26 are rotatable relative to the power plant 10, so as to enable thrust vectoring. In each nozzle, rotation is achieved by connecting the nozzles 24, 26 to the divided portions 20, 22 of plenum chamber 18, via bearings in respective housings 28, 30.

Reheat equipment (not shown) is included in the plenum chamber 18 and operation of the reheat equipment requires the ability to increase the outlet area of each nozzle 24, 26 so as to cater for the resultant increased mass flow of gases.

Referring now to Figure 2, nozzle 24 is in the form of an elbow, so that its outlet 32 is in a plane which is approximately normal to the plane of rotation of the nozzle. A flap 34 is pivotally mounted at 36 in this nozzle 24 and its length extends inwardly from the outlet of the nozzle structure. The edge periphery 38 of flaps 34 is so shaped that when the flap is in the position shown in full lines, the edge periphery 38 seals against the curved inner wall of the nozzle. The effective outlet therefore, has a depth indicated between arrowheads 40. In the configuration first described, the outlet area of nozzle 24 is the smallest possible, but should re-heat be required, that area will not be sufficient to pass the resultant increase in mass flow of the gas. Accordingly, flap 34 is pivoted to the position shown in dotted lines. Gas can then flow past both sides of flap 34, to the outlet plane 32 the depth of which has now been enlarged as indicated by the distance between arrowheads 42.

In the present example, a ram 44 is used to move the flap 34 between its two positions. The ram 44 is connected to the underside of flap 34 via a link and pin arrangement 46. However, any suitable linear actuator may be utilised.

A hole 48 is provided to enable the link portion of the connection 46 to pass through. However, in the "reheat" configuration, no gas will escape to atmosphere via hole 48, as a sole plate 50 seals the hole therefrom. The sole plate also serves to locate ram structure 44.

The construction of area varying apparatus described hereinbefore, is particularly suitable for employment with elbow type nozzles, in that it can be positioned in the crook of the elbow, as shown and so does not add to the frontal area of the power plant it is mounted upon. Moreover, mounting the apparatus thus does not affect the structural integrity of the outer portion of the elbow, which in operation, is subject to the temperature and turning force of the gas flow. However, as can be seen in Figure 1, the apparatus can be utilised on a straight nozzle.

In Figure 1 the outlet nozzle 52 of gas generator 12, has a flap 54 mounted therein in a manner identical with the flap 34 of Figure 2.

A ram mechanism 56 lies along the exterior of nozzle 52 and is connected to flap 54 via a link 58.

Actuation of ram 56 pivots link 58 which in turn pivots flap 54 into the "reheat on" position.

As link 58 will pivot about one portion of an arc and flap 54 will pivot about another portion of arc, the connection between them will have to comprise a pin and slot connection, to cater for the different movements.